

Adverse Childhood Events and Lifetime Alcohol Dependence

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Alcohol dependence is a major public health problem. National findings indicate that nearly an eighth of Americans (12.5%) met criteria at some point in their lives for *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)*,¹ alcohol dependence² and that alcohol dependence is associated with significant disability and with poor mental health.³ A better understanding of the factors underlying the risk for alcohol dependence is important for developing better prevention and early intervention measures.

Research in treated and untreated populations consistently shows that adverse childhood events (i.e., events occurring before the child is aged 18 years) predict alcohol dependence.^{2,4-6} Data from a survey conducted in the early 1990s suggested that several adverse events increased the risk for alcohol dependence after sociodemographic variables were controlled for, and the joint effect of exposure to multiple adverse events was stronger than the effect of a single adverse event.² A questionnaire survey of health maintenance organization (HMO) members suggested a linear relationship between the number of adverse childhood events and the probability of responding positively to single questions on having an alcohol problem or considering oneself alcoholic.⁵ For example, compared with those not reporting any adverse childhood events, individuals reporting 1 and 2 adverse childhood events were 2 and 4 times more likely, respectively, to consider themselves alcoholics. These studies suggest that the number of adverse childhood events is a more powerful predictor of adult alcohol-use disorders than any specific adverse childhood event.

The cumulative stress associated with experiencing several adverse childhood events has been associated with increased risk for negative mental health outcomes⁷ and might explain the increased propensity to use alcohol and eventually become alcohol dependent, perhaps seeking relief from the enduring impact of these events. Even though adverse childhood events have been shown to be associated with alcohol dependence, information is lacking on whether this association remains significant after one controls

Objectives. We sought to study the association between adverse events occurring in childhood and adolescence and lifetime alcohol dependence in a representative sample of American adults.

Methods. With data from the National Epidemiologic Survey on Alcohol and Related Conditions, we conducted logistic regression multivariate analyses to examine the impact of adverse events occurring in childhood (aged <18 years) on the lifetime prevalence of alcohol dependence. We controlled for age at drinking onset, binge drinking, alcoholism in parents and grandparents of respondents, and demographic characteristics.

Results. Adverse childhood events were associated with familial alcoholism and with early and binge drinking, and therefore, we controlled for these potential confounders. Experiencing 2 or more adverse childhood events, compared with none, significantly increased the risk for alcohol dependence, even after we controlled for sociodemographic variables and disorder-specific potential confounders not considered in the extant literature (adjusted odds ratio = 1.37; 95% confidence interval = 1.06, 1.77).

Conclusions. Individuals who experienced 2 or more adverse childhood events are at increased risk for lifetime alcohol dependence. A better understanding of the factors underlying the risk for alcohol dependence is important for developing better prevention and early intervention measures. (*Am J Public Health*. 2009;99:258–263. doi:10.2105/AJPH.2008.139006)

for other known strong risk factors that may confound the association.

Three such strong risk factors arise from an extensive literature. First, familial alcoholism is a strong risk factor for alcohol dependence.⁸⁻¹⁰ Second, early drinking onset predicts alcohol dependence in both cross-sectional and prospective studies,^{11,12} and twin studies suggest that the association is because of familial sources, reflecting shared environmental and genetic factors¹² and unique environmental factors.¹¹ Third, binge drinking is associated with the onset and chronicity of alcohol dependence in cross-sectional¹³ and prospective studies.¹⁴⁻¹⁶ Whether the association between adverse childhood events and lifetime alcohol dependence remains significant after one controls for these strong risk factors is unknown.

We addressed this question with data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a large, nationally representative survey of American adults that includes information about adverse childhood events, age at drinking onset, binge drinking, and alcoholism in parents and grandparents of respondents. The NESARC data provide a uniquely advantageous

opportunity to study the impact of adverse childhood events on alcohol dependence among adults. We hypothesized that adverse childhood events would be significantly associated with lifetime alcohol dependence and that the magnitude of this association would remain significant after we controlled for alcoholism in the 2 preceding generations and for binge and early drinking.

METHODS

Sample Design and Procedures

Our sample consisted of participants in the 2001 to 2002 NESARC, a nationally representative US survey of civilian noninstitutionalized participants 18 years and older interviewed in person. The National Institute on Alcohol Abuse and Alcoholism sponsored the study and supervised the fieldwork conducted by the US Bureau of the Census. The NESARC research protocol, including informed consent procedures, received full ethical review and approval from the US Census Bureau and US Office of Management and Budget. Young adults, Hispanics, and African Americans were oversampled; the overall

response rate was 81%. Further details of the sampling frame and demographics as well as interviewer training and field quality controls are available elsewhere.^{17,18} Our analysis included all survey participants (N=43 093).

Measures

A *DSM-IV* diagnosis of alcohol dependence was made with the Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS-IV).^{19,20} This structured diagnostic interview was designed for administration by extensively trained lay interviewers and was developed to advance measurement of substance use and mental disorders in large-scale surveys. The interview included 31 symptom questions to operationalize *DSM-IV* criteria for diagnoses of alcohol dependence.¹ Diagnoses were established explicitly following the *DSM-IV* criteria, and were made in 2 time frames: past 12 months (current) and prior to the past 12 months. We created a lifetime diagnosis by combining current diagnoses and diagnoses prior to the past 12 months. AUDADIS-IV diagnoses of alcohol-use disorders incorporate important improvements over other survey instruments by assessing alcohol abuse and dependence nonhierarchically and independently.²¹⁻²³

The reliability of the alcohol dependence diagnosis in the AUDADIS-IV has been extensively documented in clinical and general population samples^{19,21-23}; test-retest reliability ranges from good to excellent ($\kappa=0.70-0.84$). The convergent, discriminative, and construct validity of AUDADIS-IV alcohol-dependence criteria and diagnosis were tested in community samples²⁴⁻²⁸ and in international samples²⁹⁻³⁴ and were shown to be good to excellent. Further, clinical reappraisals documented good criterion validity of *DSM-IV* alcohol-dependence diagnoses ($\kappa=0.60-0.76$).³⁵ Further description of the derivation and psychometric properties of the alcohol-dependence diagnosis have been described in detail elsewhere.^{3,36-38} Demographic predictors of alcohol dependence in the 2001 to 2002 NESARC data can be found elsewhere³; briefly, there is a higher prevalence of alcohol dependence among men, younger individuals, Whites compared with racial/ethnic minorities, and those with lower completed years of education. As such, we controlled for these predictors in multivariable regression analyses.

For the sake of simplicity and to use the term previously used in the literature, we refer to adverse events occurring in childhood or adolescence (i.e., before one was aged 18 years) as adverse childhood events. We included 4 adverse childhood events in our analysis: (1) parental divorce, (2) death of a biological parent, (3) living with foster parents, and (4) living in an institution outside the home. Respondents were asked if each of the 4 events happened before they were aged 18 years. Although there was some overlap of adverse childhood events, there was not sufficient overlap to deem any 2 measures redundant (i.e., measuring the same underlying construct). The highest overlap was between living with foster parents and living in an institution outside the home (22% of respondents who lived with a foster parent also lived in an institution outside a home before they were aged 18 years). After separate bivariate analysis of each adverse childhood event, they were summed to create a count of number of adverse childhood events. No respondent reported all 4 experiences, and only 1 respondent reported 3 experiences. Thus, we created a 3-level variable representing: (1) no adverse childhood events, (2) 1 adverse childhood event, and (3) 2 or more adverse childhood events (range=2-3).

We ascertained family histories of alcohol and drug problems in separate modules of the AUDADIS-IV. We prompted participants with a definition that included examples of problems in the alcohol and drug diagnostic criteria and then we asked them whether relatives (by category) had experienced the condition as defined. The definitions read to respondents included readily observable manifestations, because these are the most likely to be known to family informants and sensitivity is the main issue in family history information.³⁹⁻⁴¹ Familial alcoholism was dichotomized and considered present if the respondent reported alcohol problems in 1 or more biological parents or grandparents.

We defined binge drinking as usually drinking 4 or more drinks (women) or 5 or more drinks (men) once per week or more during the period of heaviest use, or having a period of use during which the largest amount consumed more than once per week was 4 or more drinks (women) or 5 or more drinks (men). The criterion of 4 or more drinks (women) or 5 or more drinks (men) has been

identified by the National Institute on Alcohol Abuse and Alcoholism as discriminating high-risk drinkers,⁴² and recent Item Response Theory analysis has identified 4 or more drinks (women) or 5 or more drinks (men) once per week or more as the symptom with the best fit as an indicator of problem drinking compared with drinking the same number of drinks less often.^{43,44}

We defined early age at first drink as first drinking more than a sip or taste of alcohol before one was aged 15 years, consistent with literature showing that drinking onset before age 15 is associated with increased risk for alcohol dependence across the lifespan.^{45,46}

Statistical Analysis

We established the bivariate relationship among family history, adverse childhood events, and lifetime alcohol dependence among drinkers with crosstabs and unadjusted odds ratios (ORs) from logistic regressions. We established the relationship between the number of adverse childhood events and each of the 3 potential confounders (family history of alcohol problems, frequent binge drinking, and early drinking onset) with 3 separate logistic regression models. In these models we additionally adjusted for gender, age, race/ethnicity, and education.

We defined the relationship between adverse childhood events (each considered separately, as well as the number of adverse childhood events) and alcohol dependence by using 4 successive logistic regression models, with lifetime alcohol dependence as the independent variable in each of these models. We adjusted for gender, age, race/ethnicity, and education in each of the 4 models. In the first 3 models, we further adjusted for each potential confounder (family history of alcohol problems, early drinking, and binge drinking) separately. In the fourth model we further adjusted for the 3 potential confounders jointly. Model parameters were estimated with SUDAAN version 9.0 (Research Triangle Institute, Research Triangle Park, NC), which uses Taylor series linearization to adjust for the design effects of complex sample surveys such as the NESARC.

RESULTS

The drinking patterns and prevalence of adverse childhood events among NESARC

respondents (N=43 093), with and without lifetime alcohol dependence, and associated ORs are shown in Table 1. This table also shows the associations of alcohol dependence with each of the 3 potential confounders. As shown, all 3 were significantly related at a strong level.

When we considered the childhood adverse events separately, only 1 (parental divorce before age 18 years) was significantly associated in bivariate analyses with lifetime alcohol dependence (OR=1.81; 95% confidence interval [CI]=1.65, 1.99). However, a history of

1 (OR=1.51; 95% CI=1.37, 1.55) or 2 or more (OR=1.53; 95% CI=1.26, 1.86) adverse childhood events was associated with an increase in the odds of alcohol dependence.

To ascertain the potential for confounding from family history, early drinking onset, and binge drinking in this subset of the NESARC data, we examined the association of these variables with the adverse childhood events, adjusting for gender, age, race/ethnicity, and education. Compared with those without history of adverse childhood events, early onset drinking was about 50% more likely among

individuals with 1 (adjusted OR [AOR]=1.49; 95% CI=1.34, 1.65) or 2 or more adverse childhood events (AOR=1.53; 95% CI=1.16, 2.02). Frequent binge drinking was also more likely among those with 1 (AOR=1.16; 95% CI=1.08, 1.26) or 2 or more adverse childhood events (AOR=1.24; 95% CI=1.06, 1.49). Finally, individuals with 1 (AOR=1.76; 95% CI=1.66, 1.87) or 2 or more (AOR=1.59; 95% CI=1.36, 1.85) adverse childhood events were more likely to have a family history of alcohol problems compared with individuals with no adverse childhood events.

We next examined the robustness of the association between adverse childhood events and lifetime alcohol dependence after we adjusted for demographics and the 3 potential confounders. Considered individually, none of the adverse childhood events examined were significantly associated with alcohol dependence after all adjustments were made (data available upon request). After we adjusted for demographic characteristics and separately for each of the 3 potential confounders (Table 2; models 1–3), both 1 and 2 or more adverse childhood events were significantly associated with lifetime alcohol dependence. After we adjusted for demographics and all 3 potential confounders simultaneously (Table 2; model 4), a history of 2 adverse childhood events remained significantly associated with lifetime alcohol dependence.

We repeated the analyses restricting the sample to ever-drinkers by excluding alcohol abstainers, and the results were very similar (data available upon request). Individuals were considered abstainers if they replied negatively to the following NESARC question: “In your entire life, have you had at least 1 drink of any kind of alcohol, not counting small tastes or sips?”

DISCUSSION

We found that after we controlled for strong potential confounders, experiencing 2 or more adverse childhood events remained significantly associated with lifetime alcohol dependence. The confounders included history of alcoholism in the 2 prior generations, as well as early onset and binge drinking, 2 potential confounders not considered in previous studies. Our findings indicated a statistically significant increase of about one third in the odds of

TABLE 1—Alcohol Use History and Adverse Childhood Events Among Study Participants (N=43 093) With and Without Lifetime Alcohol Dependence: National Epidemiologic Study on Alcohol and Related Conditions, 2001–2002

	No.	Lifetime Alcohol Dependence, % (SE)	OR (95% CI)
Family history of alcohol problems ^a			
Yes	13 200	22.1 (0.5)	3.25 (2.99, 3.53)
No (Ref)	29 893	8.0 (0.3)	1.00
Binge drinking ^b			
Yes	8 923	40.9 (0.7)	16.06 (14.64, 17.62)
No (Ref)	34 170	4.1 (0.2)	1.00
Early age of drinking onset ^c			
Yes	2 600	37.3 (1.3)	5.32 (4.72, 5.99)
No (Ref)	37 908	10.1 (0.3)	1.00
Parental divorce before aged 18 years			
Yes	6 914	18.8 (0.7)	1.81 (1.65, 1.99)
No (Ref)	36 179	11.3 (0.4)	1.00
Death of a parent before aged 18 years			
Yes	4 515	12.2 (0.7)	0.97 (0.85, 1.11)
No (Ref)	38 578	12.5 (0.4)	1.00
Raised in an institution or other situation outside a home before aged 18 years			
Yes	167	12.6 (3.3)	1.01 (0.56, 1.84)
No (Ref)	42 926	12.5 (0.4)	1.00
Raised by foster parents before aged 18 years			
Yes	71	11.6 (3.9)	0.92 (0.44, 1.95)
No (Ref)	43 022	12.5 (0.4)	1.00
Number of adverse childhood events ^d			
2 or more	1 154	16.4 (1.3)	1.53 (1.26, 1.86)
1	9 358	16.2 (0.6)	1.51 (1.37, 1.65)
None (Ref)	32 581	11.4 (0.4)	1.00

Note. OR=odds ratio; CI=confidence interval.

^aDefined as a parent or grandparent with an alcohol problem.

^bDefined as usually drinking 4 or more drinks (women) or 5 or more drinks (men) once per week or more during period of heaviest use or having a period of use during which the largest amount consumed more than once per week was 4 or more drinks (women) or 5 or more drinks (men).

^cDrinking more than a sip or taste of alcohol before one was aged 15 years.

^dOccurring before the individual was aged 18 years.

TABLE 2—Change in Odds Ratio (OR) for the Effect of Adverse Childhood Events Predicting Lifetime Alcohol Dependence After Control for Family History of Alcohol Problems and Alcohol Use Characteristics: National Epidemiologic Study on Alcohol and Related Conditions, 2001–2002

Number of adverse childhood events ^{a,f}	Model 1, ^a OR (95% CI)	Model 2, ^b OR (95% CI)	Model 3, ^c OR (95% CI)	Model 4, ^d OR (95% CI)
2 or more	1.52 (1.23, 1.88)	1.63 (1.32, 2.02)	1.53 (1.22, 1.93)	1.37 (1.06, 1.77)
1	1.24 (1.12, 1.36)	1.32 (1.19, 1.46)	1.28 (1.16, 1.41)	1.08 (0.96, 1.20)

Note. N = 43 093.

^aAdjusted for gender, age, race/ethnicity, education, and family history of alcohol problems.

^bAdjusted for gender, age, race/ethnicity, education, and drinking onset before aged 15 years.

^cAdjusted for gender, age, race/ethnicity, education, and lifetime heavy binge drinking.

^dAdjusted for gender, age, race/ethnicity, education, family history of alcohol problems, drinking onset before aged 15 years, and lifetime heavy binge drinking.

^eOccurring before the individual was aged 18 years.

^fCompared with no adverse childhood events.

alcohol dependence among individuals with 2 or more adverse childhood events, compared with those not reporting any adverse childhood events, and a modest increase that did not reach significance among those reporting 1 adverse childhood event.

Furthermore, we repeated the analyses after excluding lifetime alcohol abstainers, and the results were remarkably similar. These findings are consistent with other studies that suggest that the risk of alcohol dependence increases when the number of adverse childhood events increases,⁵ but the findings advance knowledge by showing that the effects of multiple adverse childhood events remain significant after we controlled for the other factors.

In a survey conducted in the early 1990s,² parental alcoholism was treated as an adverse childhood event rather than as a potential confounder, despite the genetic contribution to alcoholism already evident at the time.⁴⁷ Given the accumulated evidence that alcohol dependence has a substantial heritable component,^{9,48} we conceptualized familial alcoholism as a potential confounder, and consequently controlled for this to more accurately determine the effects of adverse childhood events.

The cumulative stress hypothesis suggests that the cumulative effect of adverse events represents a significant risk factor for the later onset of psychiatric disorders.^{7,49} Some investigators⁴⁹ have shown that levels of lifetime exposure to adverse childhood events are associated with an increased risk for the later

development of depressive and anxiety disorders. Furthermore, it has also been shown that cumulative lifetime exposure to adverse events is associated with drug dependence⁵⁰; in this study, we are extending the finding to alcohol dependence.

An examination of specific childhood adverse events suggested that parental divorce was more consistently associated with lifetime alcohol dependence than with the other childhood adverse events examined in this study. Kessler et al. found that parental divorce was a more consistent predictor of psychiatric disorders than were other loss events.² We do not know why divorce increases the risk for alcohol dependence (as well as other disorders) in some individuals but is associated with minimal or no increased risk in others. A variety of factors might mitigate or aggravate the impact of parental divorce, such as whether domestic violence was involved, the nature of postdivorce arrangements, and the degree of hostility between the parents.

Adverse childhood events are also associated with other psychiatric disorders, raising questions about the specificity of the effect. However, there is evidence that adverse childhood events have a greater impact on substance use disorders, conduct disorders or antisocial personality, and mood disorders² than on other disorders such as anxiety disorders and phobias.² Thus, they are particularly relevant to the understanding of causal pathways associated with alcohol dependence. Controlling

for so many alcohol-specific confounders should have further narrowed the specificity of the findings to alcohol dependence. Studies of the relationship of adverse childhood events to other disorders should include a similar level of control for disorder-specific potential confounders.

Strengths and Limitations

Our study had some limitations. First, only 4 adverse childhood events were included in wave 1 of the NESARC. Sexual abuse, shown in twin studies to increase the risk for multiple psychiatric disorders among women, but especially for bulimia, alcohol, and other substance dependence,⁵¹ was not one of the adverse childhood events included in this study. Data from wave 2 of this study will include this information, leading to future studies of this issue that should employ a similar strategy of control for the relevant confounders.

Also, because only 1 individual reported more than 2 of the adverse childhood events, the range in adverse childhood event variables was limited to 1 versus 2 or more. Although the limited range of adverse childhood events diminished the chances of showing a dose–response relationship, evidence for this was still found. Additionally, the reliance on retrospective historical information is a limitation of this and all other published studies in which associations between adverse childhood events and adult outcomes were examined.^{2,5,6} Last, in cases in which alcohol dependence began before age 18 years, the temporal relation between the adverse events considered in this study and the onset of alcohol dependence is not clear.

Strengths of this study include examination of the largest population sample ever used to examine associations between adverse childhood events and lifetime alcohol dependence, and the use of *DSM-IV* criteria to ascertain alcohol dependence. Previous studies that focused on associations between adverse childhood events and alcohol-use disorders were conducted in smaller samples.^{2,52} Further, one of the main previous sources of information⁵ relied on questionnaires mailed to HMO enrollees, with self-reported alcoholism assessed using a single question (i.e., whether an individual considered him- or herself an “alcoholic”) as the outcome. Given that denial is a common feature of alcoholism, using self-reported

alcoholism assessed by means of a single question is unlikely to capture all cases.

Conclusions

We have shown that having a history of 2 adverse childhood events was associated with lifetime alcohol dependence, and this association remained significant after we controlled for sociodemographic variables and potential confounders not considered in the extant literature. Furthermore, we have confirmed what was suggested in previous literature—i.e., that it is the number of adverse childhood events, rather than any specific adverse childhood event, that is most robustly associated with alcohol dependence. Thus, individuals with multiple adverse childhood events should be considered at risk for alcohol dependence. We do not know the mechanism underlying these associations. Future studies should examine whether there is an interaction between a history of adverse childhood events and recently replicated findings on specific genetic variants (e.g., *GABRA2*, *ADH4*). These hypothesized interactions might explain, at least in part, why some individuals become vulnerable to future alcohol dependence after exposure to adverse childhood events whereas others do not. ■

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Contributors

D. J. Pilowsky originated the study and drafted the article. K. M. Keyes performed all the quantitative analyses and assisted in drafting the article. D. S. Hasin supervised the study, provided input into the study design, and assisted in drafting and reviewing the article.

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Human Participant Protection

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